Anthurium Shipping and Cold Tolerance

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ABSTRACT

Postharvest handlers and shippers of tropical ornamentals are limited by their products chilling susceptibility, short vase life, long distances to major markets, and the need for insect disinfestation. Frequently tropical ornamentals shipped to temperate areas during the winter are exposed to freezing temperatures during transit and are severely damaged. Packages can provide some protection. Cartons with ½" thick Styrofoam on all sides gave protection for up to 5 hours and could possibly give protection up to 8 hours exposure to -15℃. After freezing exposure, the cartons should be immediately unpacked to avoid longer exposures to low temperatures. The shredded newspaper traditionally used for packing in Hawaii should not be wet to avoid freezing when in contact with the flowers. Anthurium cultivars varied in their tolerance to low temperature exposure with greater tolerance being shown by Marian Seefurth, Lavender Lady, Lady Ann, Tropical Ice and Mickey Mouse.

Key words: Anthurium, Shipping, Cold Tolerance.

INTRODUCTION

The anthurium (*Anthurium andraeanum*) flower consists of a modified leaf; the glossy spathe, and the upright flower spadix in the middle of the spathe with more than 300 spirally attached minute flowers (Watson and Shirakawa, 1967). Cultivars have a wide range of colors and forms and the vase life can seasonally vary from 8 to 69 days (Paull et al., 1992). Conflicting evidence exists as to whether bacterial or physiological blockage of the vascular tissue reduces postharvest life. The end of the vase life is shown as loss of spathe glossiness and then spathe blueing due in part to water loss. The majority of the water loss occurs from the spadix.

All of Hawaii's ornamentals are shipped by air, while most foliage plants and nursery stock are sent by sea (Akamine, 1976; Paull, 1991; Criley *et al.*, 1993). The air-shipped product sent to major mainland markets during winter frequently are exposed to freezing temperature. The freezing temperatures are most commonly experienced during movement from the destination airport to the retail outlet. Packages, suitable to protect the ornamentals during cold exposures have been developed. Most of these packages use Styrofoam sheeting and reflective films. Similar packages can be used to protect products during exposure to heat during the summer.

Our recent research has focused on the evaluation of different packages to protect anthuriums during shipment. The second aspect has been to determine the relative sensitivity of anthurium cultivars to cold exposure. Before presenting the results of this research, I would like to review anthurium postharvest handling to provide a context for handling decisions.

POSTHARVEST HANDLING

Maturity of anthurium flowers is determined by the proportion of open flowers on the spadix. In immature anthuriums, the spadix is smooth. Flower opening starts at the base of the spadix and proceeds upwards; spadices with open flowers are noticeably rough. Although producers in some countries harvest anthuriums when as little as 20% of the spadix is rough, Hawaiian growers harvest flowers when only 25% of the spadix is still smooth (75% of the flowers have opened). Harvesting anthuriums when more mature increases overall vase-life. For maximum vase life, flowers should be harvested when the spadix is 50 to 75% rough.

Waxing and silver nitrate treatments increase vase life (Paull and Goo, 1982). However, waxing can cause spathe blueing of some cultivars and impart an undesirable gloss. Silver nitrate runs into the problems of cost and disposal of spent solution. The vase life can also be increased by benzyladenine applied as a dip or as a spray (Paull and Chantrachit. 2001). Different anthurium cultivars do show differences in vase life responsiveness to BA treatment from a 20% reduction to a 2.5 fold increase in vase life. The maximum vase life increase is obtained at about 100 mg L^{-1} BA for 'Leilani', 'Blush Oishi', and 'Purple Arcs'. 'Marian Seefurth' reached the maximum vase life at 150 mg L^{-1} and gave only a slight further increase in vase life at 200 mg L^{-1}. 'Ozaki' showed a slight increase in vase life at 100 mg L^{-1} (Figure 1), while 10 mg L^{-1} as used by Shirakawa et al., (1964) gave little or no increase in vase life. There was no reduction in vase life at higher BA concentrations.

The storage recommendation is between 12.5 to 20℃ (Paull, 1987). Temperatures less than 10℃ leads to chilling injury for which the symptoms are purpling and browning. Anthurium flowers can be stored for at least 1 week if packed in moist shredded newsprint and held at 15 ℃. However, detailed information on exposure temperatures and duration are unavailable.

ANTHURIUM COLD TOLERANCE

Blueing of anthurium spathes and the browning or water soaking of tissue were the symptoms most commonly observed immediately after freezing exposure. Sometimes, symptoms were not evenly distributed. It is suspected that these uneven injuries were caused by the direct contact of the spathe with the wet, frozen shredded paper used for packing. One day after unpacking, the symptoms of injury seen were discoloration and browning of the tissue. Most of these symptoms usually occurred at the tip and edge of the spathe and spadix. Marian Seefurth, Lavender Lady, Lady Ann, Tropical Ice and Mickey Mouse are anthurium varieties that are more tolerant to cold temperature exposures (Table 1). Under the same condition Kalapana Obake, Lehua red and Midori green showed marked injury.

PACKAGING TO AVOID COLD INJURY

We compared the ability of seven

different box systems to the standard ornamental's shipping box to prevent damage to flowers from freezing exposure. About 24 hours after packing, the boxed were exposed to -10°C to -15℃ for up to 5 hours, then returned to ambient temperatures (22℃) unpacked, evaluated, and vase-life determined. The different boxes evaluated were: #1.Control - Gift box, plastic liner, shredded paper, and sealed, then held at room temperature. #2. Control - Gift box, plastic liner, shredded paper, and sealed and exposed at -16℃. #3. Double box system - gift box, 4 sheets of newspaper, 2 sheets of 1/16th foam, shredded paper, 8 sheets newspaper used for #12 box/double box and seal. #4. Foam board - gift box, ½" foam board all sides (6 pieces), plastic liner, shredded paper. #5. 1/8" Foam sheet - gift box, 1 sheet 1/8" foam sheet on bottom, 1 sheet 1/8" foam liner, closed liner, 1 sheet 1/8" foam on top and seal. #6. Holographic box- plastic liner, shredded paper, and sealed. #7. Holographic box-double box system #12 box, 4 sheets newspaper, 2 sheets 1/16th foam, shredded paper, 8 sheets newspaper used for #12 box/double box and sealed. #8. Holographic box (foam board) - ½" foam board, plastic liner and seal. #9. Holographic box - 1 sheet 1/8" foam sheet on bottom, 1 sheet 1/8" foam liner, and close liner, 1 sheet 1/8" foam on top and sealed.

Boxes #4 and #8 that have a ½" foam sheets gave the best insulation protection. These two boxes were able to maintain the temperature above 5°C in the box, even when they were exposed to -15°C for 5 hours (Fig. 1). The carton with only one 1/8" foam sheet (#9), was the third best in insulating ability. The minium temperature inside the box was 2.5℃. Treatment #2 and #6 cartons did not prevent the air temperature inside the box from dropping below freezing. The double box system, (# 3 and #7) showed a similar temperature profile to treatment #5. The temperature inside these boxes dropped to below zero after five hours' cold exposure.

Table 1. The shelf life of anthurium varieties exposed to -15℃ for 5 hours held in three different cartons: #1.Control - Gift box B, plastic liner, shredded paper, and sealed, then held at room temperature. #2. Control - Gift box B, plastic liner, shredded paper, and sealed and exposed at -16℃. and #8. Holographic box (foam board) - ½" foam board, plastic liner and seal.

	Injury from freezing exposure			Vase Life (days) & Box #		
	Severe	Moderate	None	#1	#2	#8
Leilani Red	j			18	1 *	18
Lehua Red		j		21	0 *	1
Marian Seefurth Pink		j		21	4	6
Midori Green	j			35	0 *	0 *
Kalapana Obake	j			13	0 *	0 *
Tropical Fire	j			8	1 *	1 *
Lavender Lady			j	11	15	17
Lady Anne white		j		8	0 *	6
Tropical Ice	j			11	0 *	8
Mickey Mouse		j		27	0 *	4
Anthurium Leaf	j			11	0 *	11

* Injury present upon removal from freezing exposure.

The injury incidence was significantly reduced in the box packed with newspaper when compared with the box which showed similar temperature but without newspaper, when compared with carton #4 and #8. Dry newsprint in carton #4 served as an added insulator for cold temperature. The flowers in treatment cartons #3, #4 and #7 showed the least chilling injury while those in cartons #2, #6 and #9 showed the most damage. It was surprising to find that the anthurium in carton #9 showed substantial injury, though the temperature profile indicated it had a relatively higher temperature inside. The injuries may be due to the direct contact of anthurium spathe with cold air or wet newspaper surfaces.

SUMMARY

Marian Seefurth, Lavender Lady, Lady Ann, Tropical Ice and Mickey Mouse are anthurium varieties that are more tolerance to cold temperature. Under the same condition, Kalapana Obake, Lehua red and Midori green showed marked injury. Cartons with ½" thick Styrofoam on all sides gave protection for up to 5 hours and could possibly give protection up to 8 hours. After low temperature exposure, the cartons should be immediately unpacked to avoid longer exposures to low temperatures.

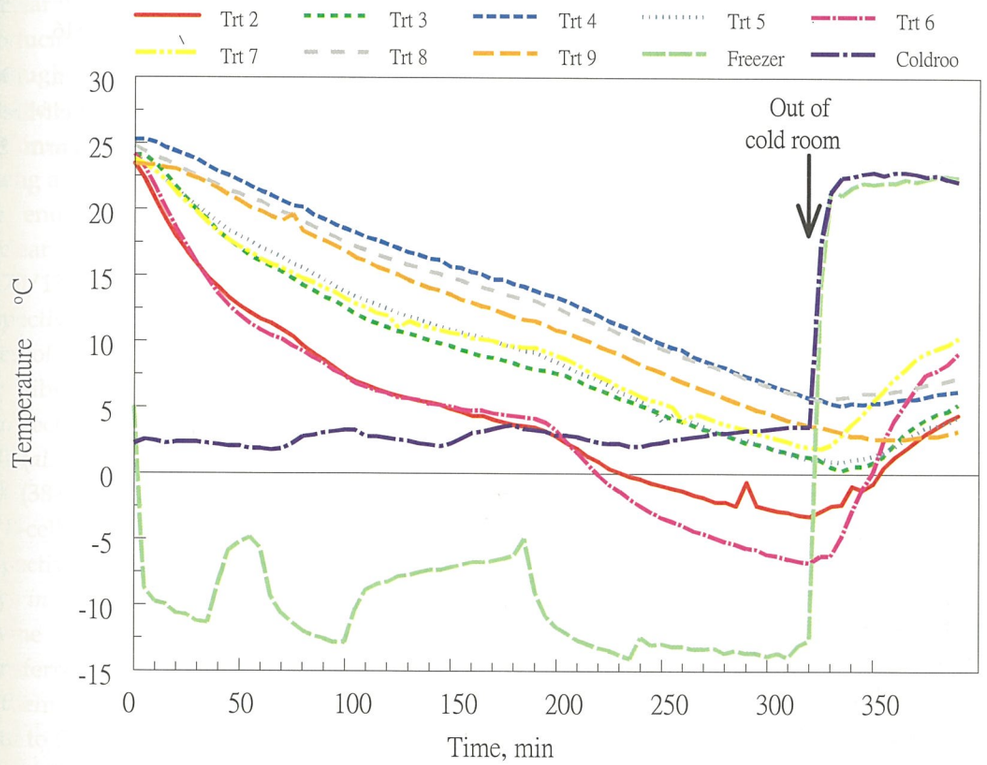

Fig. 1. Temperature profiles inside various packed flower boxes exposed to as low as -15℃.

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